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Title

[プラズマ処理装置の電極構造]

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1. [Title of the invention]

The electrode structure of plasma processor

2. [Scope of the patent claims]

(1). the electrode structure of plasma processor characterized such that the electrodes are structured by the silicon single crystal doped by the same dopant as the dopant to dope the wafer to be processed.

(2). the electrode structure of plasma processor described in the item 1 of the scope of the patent claim characterized such that the specific resistance of silicon single crystal is set 0.1Ω-cm Or less.

3. Detailed explanation of the invention.

(Utilized field in the industry)

The present invention relates to improving the electrode structure of plasma processor in the LSI production process.

(Prior arts and its problems)

Regarding plasma doping device which utilized the glow electrical discharge or ECR device, the graphite material and the like coated with aluminum, graphite, or silicon carbide (SiC) was used as electrode (called suscepter in ECR device).

The defect was that when glow electrical discharge is done by the electrode which uses these materials, since the aforementioned electrode is directly exposed to the plasma generated by glow electrical discharge, the ingredients in electrode are spattered, and fly into the plasma, hence, as impurities along with the dopant

ingredient, they were doped into the wafer to be processed.

(The purpose of the invention)

The present invention was done in view of such defect of the traditional examples, the purpose is to provide the epoch making electrode structure of plasma processor in which as the electrodes the silicon single crystal is used which was doped at high temperature with the same type of dopant as the dopant which dope the wafer to be processed, thereby, the wafer to be processed is not contaminated by the electrode ingredient.

[Means to solve the problems]

In order to attain the above described purpose, the present invention adopts the technical means in which

(1). silicon single crystal is doped by the same dopant as the dopant which dopes the wafer to be processed.

(2). This silicon single crystal is cut out, out of which the electrode (2) is structured.

And in item 2, the specific resistance of the silicon single crystals is set at 0.1Ω-cm or less.

(Action/operations)

(1). Voltage is applied to above described electrode (2), glow electrical discharge is generated, thus generating the plasma between electrodes (2).

(2). the wafer to be processed (1) quietly placed in the lower part electrode (2b) is doped by the plasmatized and ionized doping gas, however, at this time, starting with the dopant spattered from

the electrode (2) directly exposed to the plasma, including the heavy metal impurities, somewhat same ingredient as the wafer to be processed (1) flies out, is doped on the wafer to be processed (1) likewise.

(3). as a result, the ingredient in the wafer to be processed (1) does not change, and is not contaminated by the electrode ingredient, and the doping processing goes on.

(Embodiment)

The following explains the embodiment of the present invention. Various electrical discharge types are used as current plasma processor, here, as shown in figure 1, based on the ECR device (B) and the plasma processor (A) which uses the direct current power source (3) or the parallel flat plate high frequency electrical discharge which is most commonly used for industrial production, it will be explained. At the upper part inside the chamber (5) is positioned the upper part electrode (2a) connected to the direct current power source (3) or the high frequency power source (3), and directly below the upper part electrode (2a) is positioned the lower part electrode (2b) positioned to be free to rotate inside the chamber (5). In the chamber (5) is connected the gas supplying pipe (4), and is set up such that doping gas goes through the gas supplying pipe (4) and is supplied into the chamber (5). This doping gas flows as laminar current or in diffusion between the electrodes (2), and is electrical discharged to the outside from the electrical discharge pipe (6) set up an external periphery portion of such

chamber (5). And, as the above described upper electrode (2a) and lower part electrode (2b), for instance, if phosphorus is to be doped to the wafer to be processed, phosphorus doped silicon single crystal, in which phosphorus is doped at high density, is cut out, and formed into electrode (2) which is used. And, if the dopant is boron, silicon single crystal doped with boron is used and if the dopant is arsenic, silicon single crystal doped with arsenic is used, and the electrode (2) thus formed is used. Here, regarding specific resistance of the silicon single crystal, in order to be used as electrode (2) s, normally, 0.1Ω-cm Or less (as embodiment 1~0.005Ω-cm) is desired, as to arsenic doping, 0.005Ω-? Or less which is much lower (as utility embodiment, 1~0.001Ω-cm) is desired.

And, regarding doping gas, for instance, in case of boron doping, Br? Is used, in case of phosphorus doping, Ph2, in case of arsenic doping, A5H2.

However, over the lower part electrode (2b) of the plasma processor (A) of the parallel flat plate type is loaded the plural number of the wafer to be processed and while being rotated with the specified rotation speed quietly, doping gas is supplied to the chamber (5) from the gas supply pipe (4), and flows as laminar current over the wafer to be processed in the external periphery direction. At the same time, voltage is applied to the flat plate upper part electrode (2a) positioned directly above the wafer to be processed (1), high frequency electrical discharge is generated between the flat plate upper part electrode (2a) and the lower part electrode (2b), doping

gas is turned into plasma and ionized, and dopant is doped on the surface of the wafer to be processed (1) by this gas. At the same time, since the electrode (2) is directly exposed to the plasma, electrode ingredient is spattered and flies out, and at the same time, is doped on the wafer to be processed, however, since the electrode ingredient is same as the wafer to be processed (1) and the dopant, the electrode (2) does not cause contamination.

Figure 2 is an outline cross section diagram of the ECR device (II), and over the upper part of the chamber (5) is positioned the micro wave generator (3a), microwave electric power applying magnet (7), and doping gas supplying pipe (4), and at the bottom part of the chamber (5) is positioned the electrode (2a) (normally, called a suscepter, here to integrate the words used, called electrode), and over the electrode (2a) is designed to position the wafer to be processed (1), and the doping gas supplied into the chamber (5) from the gas supply pipe (4) on the upper part of the chamber (5), same as the last case, dopes the wafer to be processed (1) by the plasma action. In this case also, same as the last one, electrode (2a) is directly exposed to the plasma, and spattered, and electrode ingredient is doped on the wafer to be processed (1), but, the impurities level does not rise other than the dopant of the wafer to be processed (1).

And, the supply amount of doping gas varies, depending on the size of the chamber (5), number of sheets of the wafer to be processed (1), and speed and other factors.

used for the present invention.

Figure 2... The outline cross section diagram of the ECR device used for the present invention.

Diagrams

(A) plasma processor (B) ECR device

(1) The wafer to be processed (2)... electrode

(2a)... upper part electrode (2b)... lower part electrode

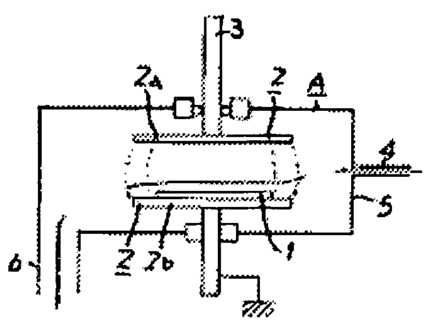
(2e)... suscepter (3)... power source

(3a) microwave generator

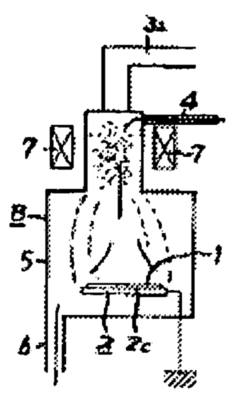
(4). Gas supply pipe (5)... chamber

(6) Electrical discharge pipe... (7)... magnet

第1図



第2図



The wafer to be processed (1) doped using the electrode (2) doped with dopant as described above is subjected to the SIMS analysis, then, the built-in heavy metal of the silicon wafer (1) which is being attempted to make a device (for instance, Fe, Cu, Ni, Cr and the like) are detected, however, it does not attain the heavy meal impurities level over this, the contamination by the doping process was not seen.

(Effects)

According to the present invention, as described above, the electrode is structured using the silicon single crystal doped with the same dopant as the dopant which dopes the wafer to be processed, hence, voltage is applied to the flat plate upper part electrode and magnet, thus, plasma is generated by exciting the flat plate upper part electrode and microwave, thus doping gas is turned into plasma and ionized, and when the dopant is doped on the surface of the wafer to be processed, at the same time, even from the electrode directly exposed to the plasma, the electrode ingredient spatters and fly out, and at the same time, dopes on the wafer to be processed, however, since the electrode ingredient is same as the wafer to be processed and the dopant, the impurities level of the wafer to be processed by the doping does not rise except for the dopant, the electrode does not become the cause of the contamination Which is the advantage.

4. Simple explanting of the diagrams

Figure 1… the outline cross section diagram of the plasma processor